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Can realistic dolls protect body satisfaction in young girls?

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ABSTRACT

Ultra-thin fashion dolls may represent a risk factor for thin-ideal internalisation and body dissatisfaction amongst young girls. We asked thirty one 5- to 9-year-old girls to engage in interactive play with commercially available dolls which were either ultra-thin (*Barbie* and *Monster High*) or represented a putative realistic childlike shape (*Lottie* and *Dora*) and to indicate their perceived own-body size and ideal body size on an interactive computer task both before and after play. There was a significant interaction between testing phase and doll group such that playing with the ultra-thin dolls led to the girls' 'ideal self' becoming thinner. A further 46 girls played with the ultra-thin dolls and then played with either the same dolls again, the realistic childlike dolls, or with cars. Initial play with the ultra-thin dolls again produced a drop in perceived ideal own body size; however, no group showed any significant change in their body ideals during the additional play phase. These data indicate the potential benefit of dolls representing a realistic child body mass to young girls' body satisfaction and do not support the hypothesis that the negative impacts of ultra-thin dolls can be directly countered by other toys.

1. Introduction

Body dissatisfaction exists in epidemic proportions in the UK (Burrowes, 2013) and is a significant public health concern (Bucchianeri & Neumark-Sztainer, 2014), particularly amongst young girls, affecting more than half of preadolescents (Wertheim, Paxton, & Blaney, 2009). It has deleterious long term consequences for girls' physical and psychological wellbeing, including eating disorders, weight gain, depression, and poor exercise and diet (Field et al., 2003; Holsen, Kraft, & Roysamb, 2001; Neumark-Sztainer, Paxton, Hannan, Haines, & Story, 2006; Stice & Bearman, 2001). Effective childhood interventions against body dissatisfaction must target and disrupt its primary causal mechanisms including thin-ideal internalisation: the tendency to adopt and pursue an unhealthily thin, unrealistically-proportioned ideal body (Thompson & Stice, 2001). Furthermore, such interventions should take place during developmental windows of opportunity targeting the most appropriate vectors of thin-ideal internalisation for the target population (Bird, Halliwell, Diedrichs, & Harcourt, 2013).

Thin ideals are composed of evaluative attitudes towards thinness and a visual representation of the ideal body (Cash & Smolak, 2011). Late childhood and the preadolescent period (for our purposes, approximately ages 6 to 11) comprise a window over which key aspects of body image schemata develop, although precise age-related trajectories still remain unclear (Neves, Cipriani, Meireles, da Rocha Morgado, & Ferreira, 2017). These key aspects include anti-fat bias (Harriger, Schaefer, Thompson, & Cao, 2019; Skinner et al., 2017), thin-ideal internalisation (Evans, Tovee, Boothroyd, & Drewett, 2013), and evaluative appearance concerns, e.g., body dissatisfaction (Paraskeva & Diedrichs, 2019). The development of young girls' thin-ideal internalisation and body dissatisfaction is multifactorial, as the tripartite model acknowledges (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999; van den Berg, Thompson, Obremski-Brandon, & Coovert, 2002), including contributions from parents, peers, and media (Harrison & Hefner, 2006; Sands & Wardle, 2003). However, the possible role of one particular form of media – toys depicting the thin ideal, such as *Barbie* or *Monster High* dolls – remains under-explored. Amongst American girls aged 5-13 years, 37% listed dolls as their favourite toys (Cherney & London, 2006). At the time our research began, a study in Israel showed that girls aged 6-11 owned, on average, 5 *Barbies* and 3 of the even thinner *Bratz* dolls (Karniol, Stuemler-Cohen, & Lahav-Gur, 2012). Dolls remain highly popular toys across the US and Europe: 2020 US sales figures showed 22% growth in the 'doll' category whilst Mattel announced 29% growth in Barbie gross sales (Businesswire, 2020).

Fashion and princess dolls often display exaggerated gender presentation in terms of secondary sexual characteristics, clothing, make-up and social roles (Murnen et al., 2016). Sherman and Zurbriggen (2014) found that after a period of naturalistic play with

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Barbie (vs *Mrs. Potato Head*), girls aged 4-7 years reported a significantly smaller range of potential future occupations for themselves than for boys. This effect was present regardless of *Barbie*'s clothes (dress vs doctor's outfit), suggesting that the connotations of the doll-type overrode an outfit marketed as aspirational and empowering. Our period of focus, during which doll play is particularly common, is also a period of marked divergence between boys' and girls' body ideals. During this period, girls begin to be differentially and increasingly socialized to internalize an observer's perspective of their own bodies, i.e., to self-objectify (Fredrickson & Roberts, 1997; Perez, Kroon Van Diest, Smith, & Sladek, 2018). Indeed, girls aged 6 to 14 years demonstrably engage in implicit appearance-based self-comparisons with Barbie (Nesbitt, Sabiston, deJonge, Solomon-Krakus, & Welsh, 2019). As such dolls represent a highly relevant source of information about gender-specific body ideals (Boyd & Murnen, 2017) during a key period of development.

Our visual prototype of bodies – which is to say the cognitive 'template' our brains use to represent the bodies we see or imagine – may be subject to external influence through basic visual exposure. Such impacts on prototypes may then shift our ideals in the same direction. For instance, 'adaptation' effects can drive children's and adults' preferences for 'attractive' faces in the direction of recently viewed exemplars where those exemplars have some feature in common (Anzures, Mondloch, & Lackner, 2009; Bestelmeyer et al., 2008; Rhodes, Jeffery, Watson, Clifford, & Nakayama, 2003). Similarly, studies have found that adults' preferences for 'attractive' body weights can be manipulated by viewing a number of larger or smaller bodies, even where those bodies are neutral or relatively negatively valenced (Boothroyd, Tovee, & Pollet, 2012; Winkler & Rhodes, 2005). It is hypothesized that these effects in faces and bodies are driven by the repeat-exposure of these extreme stimuli, altering the underlying prototype or reference template for a typical face or body (Rhodes et al., 2003; Boothroyd et al., 2012; Winkler & Rhodes, 2005).

Current commercially available dolls aimed at children tend towards an ultra-thin figure; the projected body mass index (BMI) of *Barbie* is 16.2 kg/m^2 (BMIs below 18.5 are considered underweight in UK adults). Barbie-style fashion dolls such as *Steffi* and *Disney* character dolls show similar proportions, while *Monster High* dolls have particularly extreme proportions with projected BMIs of below 10, based on waist circumference. Children's visual representations of human bodies may be affected by inanimate dolls in the same manner as by photographs of real bodies and faces. Furthermore, girls may internalise qualitative and associative information through doll play, including sex role related attitudes (Sherman & Zurbriggen, 2014). We would therefore predict that girls playing with unrealistic, unhealthily thin dolls may be likely to internalise thin body ideals.

To date, four studies have examined the potential impacts of dolls on children's body weight preferences. Dittmar, Halliwell, and Ive (2006) found that 5-year-old (but not 8-year-old) girls who had viewed images of *Barbie* reported higher body dissatisfaction than girls shown pictures of a 'plus-size' doll; however, these authors did not investigate actual play. Contrastingly, Anschutz and Engels (2010) found that 10 minutes of playing with a 'thin' vs 'average' weight doll did not affect the body image of 6- to 10-year-olds (although there was a difference in subsequent snack consumption). More recently, Jellinek, Myers, and Keller (2016) found that girls who played with a more realistic weight doll showed less body dissatisfaction than girls who played with *Barbie*. Rice, Prichard, Tiggemann, and Slater (2016) compared the effects of looking at and playing with *Barbie* versus a control toy. They found no effects on body size satisfaction using figure choice scales in any condition but girls who had been exposed to *Barbie* in any manner reported higher levels of thin-ideal internalisation than control participants.

These studies show mixed results regarding the impact of thin dolls on body size ideals in children. Some of this variation may arise from the general lack of baseline testing. Although randomisation of participants into conditions and large samples should reduce noise in pre-existing ideals, baseline testing offers the most sensitive test of change within individuals and is typical practice within visual aftereffects research, including with children (Anzures et al., 2009). A second consideration in these previous studies is that both ultra-thin and realistic weight dolls depicted adult/young adult women. While this controls for the possible effects of doll age in itself on girls' perceptions, these adult dolls remain very unlike the children themselves. In the current study, therefore, we compared typical ultra-thin dolls (*Barbie* and *Monster High*) with dolls representing a 'realistic' weight child of a similar age to our participants – i.e., a suitable model for their own body. *Lottie* is based on the average proportions of a UK 9-year-old, and *Dora* depicts a 7-year-old. If doll play does alter body ideals, we would predict that playing with the ultra-thin dolls should cause children's perceived ideal body size for themselves, and possibly also for adult women, to become thinner. Furthermore, this change in ideal may lead to greater body dissatisfaction in terms of greater distance between ideal self and perceived actual self. Study 1 therefore tested the specific hypotheses that play with ultra-thin dolls would lead to a negative shift from pre- to post-test in ideal self, ideal adult, and body satisfaction, relative to play with realistic, childlike dolls. Study 2 took a step further and asked: if play with ultra-thin dolls does lead to a drop in perceived ideal, can play with realistic childlike dolls counter this effect?

2. Study 1

2.1. Materials and methods

2.1.1. Participants

Visual adaptation studies in adults suggest 16 participants per condition give 90% power for a significant phase-by-condition interaction in a mixed design such as ours (based on a partial eta^2 of 0.310 for a similar 2-way interaction for adults judging 2D body stimuli in Boothroyd et al., 2012; sample size calculations run in GPower). Thirty-five girls aged 5-9 years (M = 7.77 years, SD = 1.2) were therefore recruited through local state schools in moderately economically deprived neighborhoods (c., 30-40% of children receiving free school meals), and the department's families database (predominantly middle class families). All but one child were White British. In order to understand pre-existing exposure in our sample, parents completed a questionnaire on doll and media use which showed that 84% of participants had access to ultra-thin fashion dolls outside the study (i.e., had dolls at home or played with a friends' dolls; see Appendix B for more detail). Four children were excluded from analyses due to distraction during testing (e.g., not looking at the screen while making a selection, appearing to wave the mouse around randomly, etc.) leaving 15 children in the 'ultra-thin' doll condition and 16 in the 'realistic childlike' doll condition. Ethical approval was given by the Department of Psychology ethical committee at the University of Durham. Parents provided written consent and children gave verbal assent before participation.

2.1.2. Body size perception task

At baseline and post-test children indicated their perceived actual body size ("What looks most like you?"), ideal body size ("How would you most like to look?") and ideal adult body size ("Can you make the woman look as attractive and beautiful as possible?") using a computer-based interactive continuous figure choice test. In each stage of the test, they selected the body size by moving the mouse left and right which morphed a stimulus body from emaciated to obese (see Fig. 1 below for example). In contrast to

Fig. 1. The body size perception task with the image at the thinnest and largest extremes.

traditional figure choice scales (e.g., CBIS; Truby & Paxton, 2002, 2008), in which children select one perceived figure and one ideal figure from a small array of differently sized figures, the task used in these studies used a larger number of figures, displayed such that a single body appeared to increase/decrease smoothly in simulated adiposity in a continuous fashion as the mouse was moved from one side of the screen to the other.

The bodies were created in Daz Studio (Daz3d.com) using the genesis models. Body size and shape were based on averaged 3D scans of real children and adults of known BMIs (see Jones et al., 2018 for details) and ranged between the 2nd and 95th centiles for a 9.5-year-old girl. This enabled the creation of stimuli which represented the interpolated average shape at any given BMI within the range of bodies sampled. The bodies were presented at an angle of 45° relative to the observer, as this allows a finer body size discrimination than front-view (Cornelissen, Cornelissen, Groves, McCarty, & Tovee, 2018) and were approximately 700 pixels tall. Example stimuli are shown in Fig. 1. Children completed two identical trials for each stage of the task, with left-right direction of the size changes randomised. Scores were recorded as the average percentage deviation from the midpoint across both trials. For instance, a child moving the mouse all the way to the 2nd-centile side of the screen, making the image look as thin as possible, on both trials would have received a score of -50.

The test was developed by Evans et al. (2013) for testing body satisfaction in girls of the same age and data from their sample shows good test-retest reliability at five minute (ideal α = .80, perceived α = .92) and two-week intervals (ideal r = .68, perceived r = .69). Re-analysis of that same data showed no significant change in ideal self across a 5-minute interval (all ts < 1.40, all ps > .150, df = 42-50 except for a trend for Actual self to be perceived as slimmer after 5 minutes delay (t_{48} = 1.93, p = .060). In order to minimise overspill effects from actual to ideal self, participants completed a distractor task in between, where they indicated their forced choice preference between pairs of non-human stimuli (e.g., a picture of a pen versus a pencil, or a square versus a hexagon). To reduce noise in the data, all participants completed all tasks in the same order: actual self, distractors, ideal self, ideal adult.

2.1.3. Procedure

Children were tested either in a quiet room in their school or in the laboratory. Children were tested in pairs wherever possible to increase ecological validity of the play phase (N = 28), or individually with the experimenter (3 children due to odd numbers of participants in a class/school, the remainder when only one child could be booked into the laboratory at a time). Children first completed the body size perception task. When tested in pairs, they were unable to see each other's screens and were given individual instruction in a low voice by separate experimenters where possible. The experimenter showed the participants the full range of body-size change possible on the first trial and then left the mouse in the centre of the screen. Following completion of the body size task, the participants were thanked and told they were now going to play with some dolls.

Two dolls were then produced: *either* a *Barbie* in a riding outfit and a *Monster High* Claudeen doll in basketball kit (ultra-thin doll condition) *or* one *Lottie* doll in a riding outfit and a *Dora* doll in a skirted swim suit (realistic childlike doll condition; see Fig. 2 for photographs). Participants chose which doll they wanted to play with and the pairs playing together were then asked if they could make the dolls "have a conversation." A further prompt was given if necessary: "what do you think they did yesterday?" For participants tested individually, the experimenter used a set of prompts in the conversation between dolls ("Hello, what's your name? Do you have any pets? What did you do yesterday? Do you like going to the park?") and encouraged the child to act out activities mentioned with the doll, but otherwise followed the child's lead. Play sessions lasted five minutes, after which the participants were thanked for playing and the dolls were put away.

Children were then told they were "going to do a bit more on the computer" and proceeded to complete the body size task using identical instructions as at baseline. At no point during post-test were the words 'again' or 'like before' used. Finally, children were thanked and returned to class or their parent. Children tested in school were asked not to talk to their friends about the study until "everyone has had their turn".

A study procedural schematic is provided in Fig. 2. Example play and testing session videos are available at https://osf.io/6g9rh/files/ ; further details provided in Appendix A.

2.2. Results and discussion

Descriptive statistics for all outcome measures are given in Table 1. Two children had outlier scores on Ideal self at baseline (scores >3 SD below the mean); removing their data from analyses of ideal self did not change the results and so they were left in. In order to test the effect of doll play on body ideals across the experiment, mixed model ANOVAs were conducted in SPSS 22

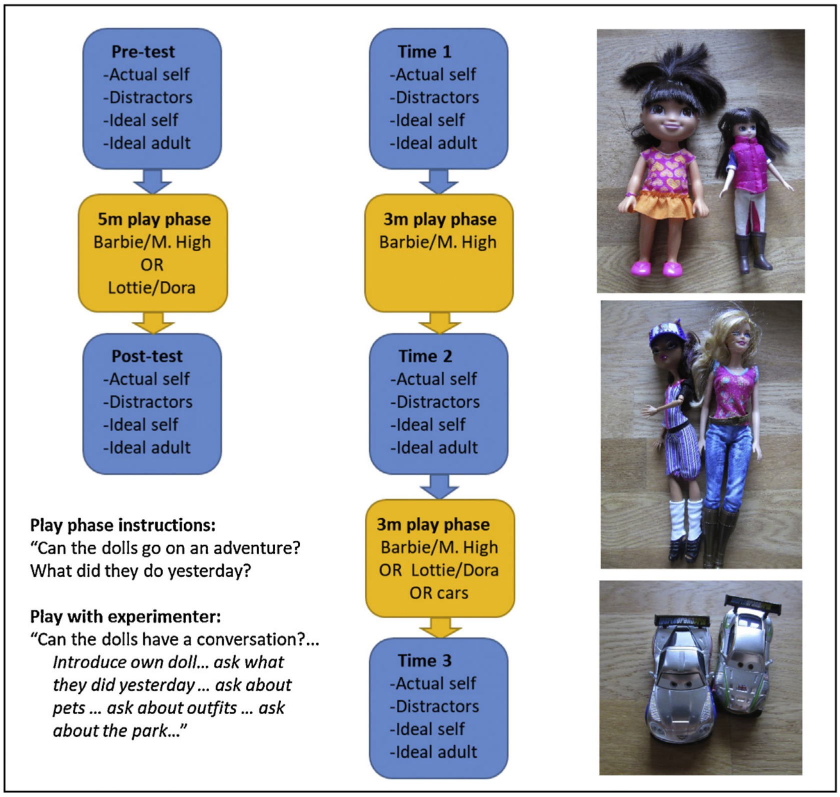

Fig. 2. Schematic of experimental procedures for Study 1 (left) and Study 2 (right) and photographs of the toys used. Verbal prompts for play phases were the same for all play phases.

Table 1
Means and SDs for all measures by condition in Study 1.

		Ideal self		Actual Self		Ideal adult		Discrepancy	
Condition		Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Thin N = 15	Mean	−1.414	−13.323	-.524	−5.794	−6.974	−12.926	-.890	−7.530
	(*SD*)	(4.69)	(14.53)	(12.25)	(19.66)	(12.00)	(15.95)	(11.93)	(16.68)
Realistic N = 16	Mean	−8.014	−4.196	3.460	−6.948	−6.267	−1.442	−11.474	2.752
	(*SD*)	(17.23)	(14.50)	(6.90)	(18.09)	(13.04)	(16.39)	(18.28)	(14.85)
Total N = 31	Mean	−4.820	−8.613	1.532	−6.389	−6.609	−6.999	−6.353	−2.223
	(*SD*)	(13.03)	(15.01)	(9.90)	(18.56)	(12.35)	(16.94)	(16.20)	(16.35)

with follow-up comparisons between pre- and post-test for each group. Time (pre- versus post-test) was entered as a within participants factor, with condition (thin versus realistic childlike dolls) as a between participants factor. Actual self, ideal self and ideal adult body sizes were analysed separately, followed by body satisfaction (calculated as actual minus ideal self). The key test of our hypotheses for each variable is whether there was a significant time by condition interaction.

Results of all models are shown in Table 2 and illustrated in Fig. 3. For body size ideals, there was a significant interaction between time and condition for ideal self and ideal adult body sizes. Planned comparisons showed that playing with the ultra-thin dolls significantly reduced the projected BMI of the children's ideal-self (t_{14} = 2.09, p = .02) and led to a marginal drop in ideal adult (t_{14} = 1.898, p = .079). In contrast there was no significant change following play with the realistic childlike dolls (ideal self t_{15} = -1.551, p = .142; adult t_{15} = -1.321, p = .206). In other words, girls endorsed a thinner ideal body at post-test if they had been exposed to ultra-thin dolls. For perceived actual self, there was an unexpected main effect of time, such that girls estimated their own body size as smaller at post-test, but no interaction with condition.

For overall body satisfaction, the interaction between time and condition was significant, such that playing with the realistic childlike dolls increased body satisfaction (t_{15} = 2.328, p = .034). In contrast, while mean body dissatisfaction was lower after playing with the ultra-thin dolls this difference was not significant (t_{14} = 1.542, p = .145).

We note that the interaction for ideal body size was driven predominantly by change in the ultra-thin doll condition, while the interaction for body satisfaction was driven predominantly by change in the realistic childlike doll condition. Overall, however, there is clear evidence for playing with ultra-thin dolls inducing a preference for a slimmer body amongst 6-9-year-old girls, and no evidence that playing with realistic childlike dolls has such an impact. Similarly, test-retest data from a different sample in Evans et al. (2013) demonstrated that preferences did not change over a similar interval without exposure to body-related stimuli. This suggests that the results in the ultra-thin doll condition represent a meaningful impact of those dolls. Although some studies have failed to find an impact of ultra-thin dolls on body ideals using figure-choice scales (Anschutz & Engels, 2010; Rice et al., 2016), our use of baseline testing improves our chances of detecting change within individuals, and our body perception task gives much finer

Table 2
Results of Time (pre- versus post-test) by Condition (ultra-thin versus realistic childlike dolls) mixed ANOVAs on body size perceptions in Study 1.

		F	*p*	partial eta^2
Ideal self	Condition	.079	.780	.003
	Time	4.063	.053	.123
	Condition x time	15.351	<.001	.346
Actual self	Condition	.118	.734	.004
	Time	4.992	.033	.147
	Condition x time	.536	.470	.018
Ideal adult	Condition	1.752	.196	.057
	Time	.054	.818	.002
	Condition x time	4.952	.034	.146
	Condition	.001	.971	.000
Body dissatisfaction	Time	1.005	.324	.033
	Condition x time	7.604	.010	.208

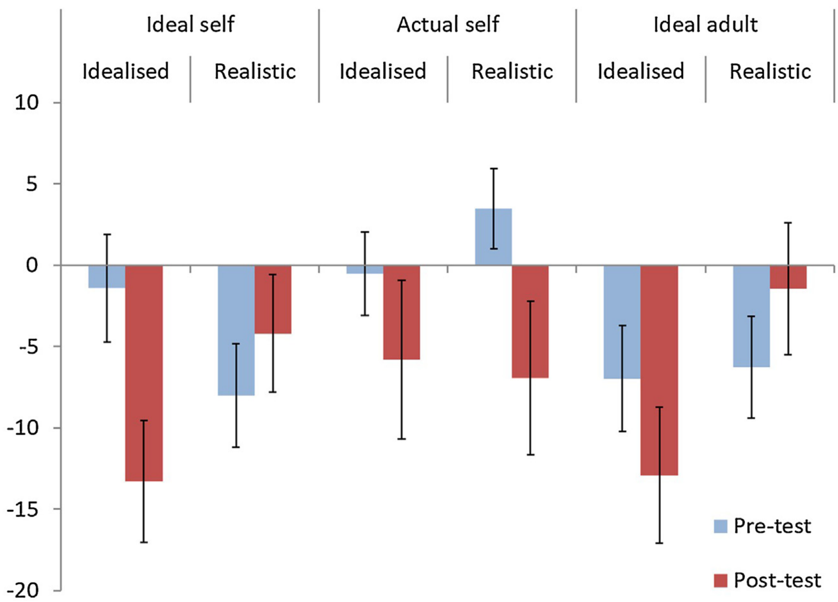

Fig. 3. Body size perceptions at pre- and post-test for each doll condition. (Error bars show 1SE) Intercept represents the midpoint in the full range of each body size continuum. * pair-wise significant differences from pre- to post-test.

grained responses and is thus more sensitive to the small changes which such a short period of exposure is likely to induce.

3. Study 2

The purpose of Study 2 was to test whether playing with these same realistic childlike dolls could offset the impact of the ultra-thin dolls and actively increase ideal body size in children after they had played with an ultra-thin doll. As such, a sequential-play paradigm was utilised in which all children played with the ultra-thin dolls and were then split into three groups for a second play session in which they played with either the ultra-thin dolls again, or the realistic childlike dolls, or played with cars to represent a control period in which the effect of the initial play phase might abate (for instance, some facial adaptation studies have found effects lasting only a few minutes: Rhodes, Jeffery, Clifford, and Leopold (2007)). We hypothesised that all children would show a drop in ideal body sizes after the first play session with the ultra-thin dolls but that those in the realistic childlike doll condition, and perhaps the control condition, would then show increases in ideal body sizes after the second play phase. Furthermore, because a larger number of participants were included in the (initial) ultra-thin condition versus in Study 1, we also explored whether the initial impact of playing with the ultra-thin dolls on body perceptions was associated with age; Dittmar et al. (2006) found stronger impacts on viewing Barbie amongst their younger participants. As such, we tested whether the change from baseline to Time 2 (after the first play phase) was associated with participant age. Finally, we explored tests of whether parent-reported media and doll exposure was associated with baseline body perceptions. These hypotheses and exploratory analyses were pre-registered (https://osf.io/6g9rh/).

3.1. Materials and methods

3.1.1. Participants

Fifty-four children were recruited through similar local schools as in Study 1, the families database and a local summer camp and alternated within classes/age brackets into conditions. All children were tested in pairs except for a small number of those tested in the laboratory. Data for eight children were removed due to distraction or cessation of participation partway through, leaving a total of 46 children aged 5-10 years (M = 8.3 years, SD = 1.2). All but three children were White British. Computer error meant that Time 1 ideal adult data for one additional child was lost.

3.1.2. Parent questionnaire

Parents reported their child's current doll and media usage, specifically whether their child already played with Barbie or sim-

Table 3
Means and SDs for all measures by condition in Study 2.

		Ideal adult			Ideal self			Actual self			Discrepancy		
		Time 1	Time 2	Time 3	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
Control N = 15	Mean	−8.265	−16.542	−18.715	−5.994	−14.475	−12.519	−4.051	−4.686	−9.108	−1.943	−9.790	−3.411
	(SD)	(16.08)	(20.92)	(19.89)	(14.83)	(17.23)	(21.01)	(13.57)	(18.67)	(20.75)	(25.20)	(28.35)	(30.02)
Thin N = 15	Mean	−4.659[i]	−2.665	−1.943	−1.741	−9.792	−7.014	−6.572	−10.681	−15.475	4.831	0.889	8.461
	(SD)	(12.90)	(12.32)	(14.61)	(9.62)	(18.93)	(14.90)	(12.09)	(15.83)	(17.65)	(16.10)	(20.52)	(17.47)
Realistic N = 16	Mean	−4.904	−5.182	−12.257	−8.020	−9.811	−7.476	−11.949	−12.153	−9.117	3.929	2.342	1.641
	(SD)	(14.04)	(9.86)	(17.40)	(18.22)	(14.87)	(11.85)	(17.56)	(15.96)	(16.61)	(17.22)	(17.44)	(14.56)
Total N = 46	Mean	−5.948	−8.065	−11.000	−5.312	−11.326	−8.970	−7.620	−9.238	−11.187	2.308	−2.088	2.217
	(SD)	(14.19)	(15.89)	(18.39)	(14.66)	(16.80)	(16.11)	(14.73)	(16.79)	(18.22)	(19.65)	(22.63)	(21.67)

[i] one participant's data was missing for this measure at Time 1.

Table 4
Results of ANOVA models testing change in body perceptions between time 2 (after first play phase with ultra-thin dolls) and time 3(after second play phase with Ultra-thin, Realistic, or Control toys).

		F	p	partial eta^2
Ideal self	Condition	.570	.570	.026
	Time	1.099	.300	.025
	Condition x time	.011	.989	.001
Actual self	Condition	.596	.555	.027
	Time	.729	.398	.017
	Condition x time	1.141	.329	.050
Ideal adult	Condition	4.809	.013	.183
	Time	1.160	.288	.026
	Condition x time	.755	.476	.034
Body dissatisfaction	Condition	4.809	.013	.183
	Time	1.160	.288	.026
	Condition x time	.755	.476	.034

ilar dolls, the frequency of play and quantity of their dolls, and whether and how often they watched both *Disney* films (given the link between *Disney Princess* engagement and body esteem; Coyne, Linder, Rasmussen, Nelson, & Birkbeck, 2016) and children's television. Full breakdown of parent responses on all items is given in Appendix B.

3.1.3. Procedure

Children completed the same body perception task as before, with the one difference: the distractor stimuli were different at each test point. The opening phase of the experiment was run in an identical manner as before, with all children given the ultra-thin dolls. Following the second body size perception task, all children were told that their initial play "was really great," and we would like them to play with the dolls again/some other toys too. They then completed the second play phase as the first and did the final post-test body size task. Cars with faces were used for the control condition in order to avoid any body related stimuli (e.g., animal toys) but allow the same instructions to be used. Initial piloting showed that two five-minute play phases was too long to maintain interest during the second phase, and so two three-minute play phases were used instead.

3.2. Results and discussion

Descriptive statistics for all measures are given in Table 3. Our exploratory analyses showed no associations between baseline body perceptions and play with dolls, or consumption of Disney and related media as reported by parents (see supplementary table S5). One participant had an outlier score on ideal self at baseline, and another had an outlier score on body dissatisfaction at baseline; removing them from the ideal self/dissatisfaction analyses respectively did not change the results reported below so they were retained in the analyses.

Our first key analyses aimed to test whether we had replicated the drop in ideal self and ideal adult shown in the 'ultra-thin' condition in Study 1. Body perception data were therefore compared across the first play phase using paired t-tests. There was a significant drop in ideal self from Time 1 to Time 2 (t_{45} = 2.354, p = .023 but no change in ideal adult body size (t_{44} = 0.705, p = .484) or perceived own body size (t_{45} = 0.571, p = .571). The absolute magnitude of the change in ideal self was smaller than in Study 1 (6% of the screen width vs 11% in Study 1), which may be because play sessions lasted 3 minutes instead of 5. Alternatively, there is a well-established phenomenon whereby replication studies typically show smaller effect sizes than the original results, which may also be the case here (Ebersole et al., 2020; Open Science Collaboration, 2015). Furthermore, our exploratory analyses showed no evidence that this shift towards preferring a slimmer figure after play with the ultra-thin dolls was weaker in older participants; the correlation between age and difference in ideal self between Time 1 and Time 2 approached zero (r = -.042, N = 46, p = .783). Running a mixed ANCOVA (repeated measure of time, age as a covariate, and the age-by-time interaction included) showed no main effect of age ($F_{1,44}$ = 0.97, p = .757) and no interaction between age and time ($F_{1,44}$ = 0.76, p = .783), although we note it also eliminated the main effect of time ($F_{1,44}$ = 0.003, p = .955).

Our second set of key analyses focused on whether play with realistic childlike dolls or control toys (cars) ameliorated the effect seen above. Mixed ANOVAs were run to assess whether toy condition affected the change in body ideals between Time 2 and Time 3. As in Study 1, our hypotheses would be supported if there was an interaction between time and group, such that some groups' ideals became larger or slimmer than others between Time 2 and 3. Time was entered as a repeated measures factor, and condition was entered as a between-participants factor. As shown in Table 4, there was no significant interaction between condition and time for any of the body perception outcomes, nor was there any main effect of time for any of the outcomes.

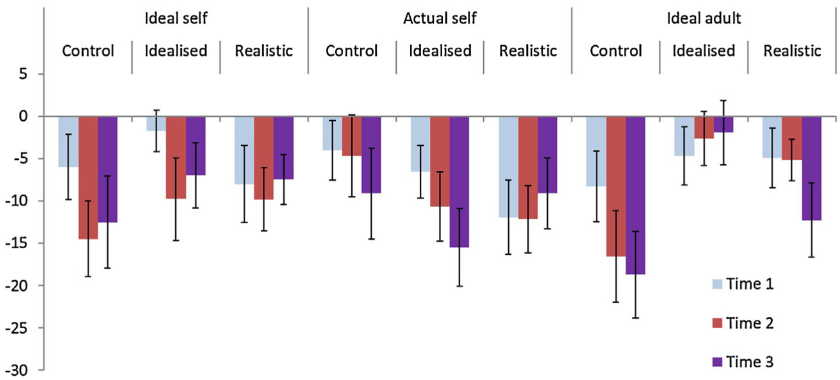

Fig. 4. Body size perceptions at each test point for each group in Study 2. Time 1 = baseline, Time 2 is after initial play with the ultra-thin dolls for all participants, Time 3 is after additional play with the ultra-thin dolls, realistic childlike dolls or cars (control). Error bars show 1SE and intercept represents the midpoint in the full range of each body size continuum.

These data strongly suggest that once an initial shift in body ideals has been induced through play with ultra-thin dolls, that shift does not immediately wash out, although nor does additional play 'top-up' the effect in a dose-response manner. The pattern of means in Fig. 4 does not suggest that a significant result would have been found with a larger sample.

4. General discussion

The aim of the current studies was to examine whether playing with ultra-thin dolls resulted in a shift in children's visual perception of their ideal body size, and therefore an increase in body dissatisfaction. The use of an interactive body perception task allows finer grained, more sensitive assessment of ideal body perception than traditional figure choice scales (Cornelissen, McCarty, Cornelissen, & Tovee, 2017; Gardner & Brown, 2010). We established in Study 1 that when girls played with ultra-thin fashion dolls (in this case *Barbie* and *Monster High*) they indeed showed a significant reduction in their ideal body size and an increase in body dissatisfaction relative to girls who had played with realistic weight, child-like dolls. Not only were we able to replicate the negative impact of thin dolls on girls' body ideals in Study 2, but we also demonstrated that these impacts cannot be immediately countered through play with realistic childlike dolls, nor washed out following play with a control toy (cars).

The primary conclusion drawn from our study is thus that ultra-thin dolls, sold in the millions each year, represent a significant potential risk to girls' body ideals which is not easily countered. This concords with earlier findings by Dittmar et al. (2006) and Jellinek et al. (2016) that looking at or playing with thin fashion dolls is associated with a reduction in girls' ideal body size and a related increase in body dissatisfaction. Furthermore, they suggest that the lack of such an effect in the figure choice data in Rice et al. (2016) and Anschutz and Engels (2010) may derive in part from a lack of baseline testing as well as the impacts of line-drawn figure scales on ecological validity and sensitivity.

It is important to note that we did not record the doll with which each child (within a pair) chose to play. As such, it is not possible to – for instance – test whether the *Monster High* doll Claudeen (which is considerably thinner even than *Barbie*) yielded a stronger effect for the children who selected that doll. Similarly, we cannot determine if either of the realistic childlike dolls was responsible for a greater proportion of the apparent protective influence in Study 1. While *Lottie* is based on a typical UK 9-year-old, *Dora* resembles a younger child and her stomach protrudes slightly (as many pre-pubertal children's stomachs do). Regardless, playing with these realistic dolls together clearly has no negative impact on girls' body image. The finding that playing with them after playing with ultra-thin dolls did not improve body image in Study 2 seems at odds with the results of Study 1. Given that most children were tested in school/summer camp or after a journey to the laboratory, none of them had been playing with dolls in the hour or more preceding testing (see Appendix C in supplementary materials for ideal-self breakdown by location). The effects of doll play may be predominantly impactful in the initial stage of play and a longer period of time may be required for them to become malleable once more. (Although in contrast, in perception research 'top-up' trials are often used to increase exposure to target stimuli during the post-test phase, in order to prevent the impact of the manipulation from fading.) In this case, play with realistic childlike dolls may be beneficial in isolation (e.g., the day after play with thin dolls), but cannot be considered at this stage to be an effective way of protecting girls from the immediate impact of thin dolls.

Our results, particularly in combination with the prior findings by Dittmar et al. (2006), Jellinek et al. (2016) and Rice et al. (2016), strongly suggest that body ideals are a key domain in which ultra-thin fashion dolls may represent a risk to the psychological development of pre-pubertal girls. Although we did not test the specific mechanism by which dolls had this effect, theory would suggest that multiple routes are likely to be in operation, independently or in concert. The finding that girls' ideal self was significantly thinner after playing with ultra-thin dolls might be explained on the basis of internalisation of ideal body parameters in response to exposure via, for example, sociocultural internalisation (see e.g., Anschutz, Engels, Van Leeuwe, & Van Strien, 2009) and/or visual adaptation effects (e.g., Boothroyd et al., 2012). Importantly, in previous work testing 'simple' visual exposure versus associative learning effects in changing body size ideals, both routes were demonstrated to operate. As such, it is likely that idealized dolls such as Barbie change girls' body ideals through *both* the cultural associations ultra-thin dolls carry *and* visual exposure effects on body prototypes.

As noted in the introduction, we concentrated on pre-adolescent girls, where the majority of doll play is found. Although some have argued that later in development adolescent girls may consciously reject Barbie as a role model (see e.g., Kuther & McDonald, 2004), negative body image in the pre-adolescent period is a cause for concern in its own right, and is linked to depressive symptoms, disordered eating attitudes, and rigid dietary restraint (Evans et al., 2017) in keeping with the sociocultural model (Stice & Agras, 1998). Our results therefore still have implications for practice. Specifically, when including the lack of amelioration seen in Study 2, caregivers concerned about the impact of ultra-thin fashion dolls on young girls' wellbeing may have greatest success in reducing such impacts by providing realistic dolls alone.

Future researchers may wish to build on our study by examining multiple types of doll independently. This might include the new 'curvy' Barbie released in 2016 (who nevertheless has a size 8 figure and an exaggerated waist-hip ratio). Such studies might also compare the effects of dolls of different ages but similar body types (or vice versa), and/or include questionnaire-based measures of self-objectification and social comparison in order to unpack the potential causal factors in our study. For instance, we aimed to compare the effects of playing with idealized adult dolls versus a realistic model for the participants' own bodies (i.e., an average sized childlike Lottie); in contrast previous studies such as Anschutz and Engels (2010) used two adult-like dolls. Future studies could use idealized versus realistic dolls of both adult and child appearance, in order to determine whether own-age dolls increase social comparison or whether adult-like dolls represent a more powerful model. We would also recommend future studies recruit large samples; although our studies were sufficiently powered for a within-participants design, it is nevertheless clear in current psychological literature that powering studies based on the smallest likely effect size is essential to accurately estimate actual effects (Lakens, Scheel, & Isager, 2018).

Finally, it is important to note that our test stimuli and participants were overwhelmingly White British. Also, although we recruited predominantly from schools with substantial low socioeconomic enrolment, we did not explicitly collect or analyse data on the socioeconomic status of our participants. Furthermore, we have no data on parental attitudes, siblings, or body-related hobbies. As such future research should also consider explicitly, how widely applicable our results are, in terms of whether participant and doll ethnicity, as well as broader demographic and psychosocial profile, interact in the effects seen here. Finally, the current data focus on the impact of ultra-thin dolls on girls' body perceptions; however, given the high rates of muscularity in boys' action figures (Boyd & Murnen, 2017), such toys may also represent a risk to body satisfaction and drive for muscularity in young boys (for related work see e.g., Baghurst, Hollander, Nardella, & Haff, 2006; Baghurst, Carlston, Wood, & Wyatt, 2007; Baghurst, Griffiths, & Murray, 2018).

Overall, these studies show an effect of playing with ultra-thin fashion dolls on girls' own body ideal which may represent a risk to body esteem. We strongly urge future research on the impacts of doll play on body image to consider the potential importance of own-age versus adult dolls, use of baseline testing and how combinations of toys as in real world play settings, may dilute or magnify these experimental impacts.

Declaration of interest

None.

CRediT authorship contribution statement

Lynda G Boothroyd: Conceptualisation, Methodology, Data curation, Software, Writing - original draft, Writing - review & editing. **Martin J Tovée:** Software, Writing - review & editing. **Elizabeth H Evans:** Conceptualisation, Methodology, Data curation, Software, Writing - review & editing.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.bodyim.2021.02.004.

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